**Appendix 2** Taxa and GenBank accession numbers for the ITS, *trnL-F*, and *trnH*-*psbA* sequences downloaded from GenBank and used in the phylogenetic analyses. New sequences generated for this study are shown in Appendix 1.

CLEOMACEAE. *Cleome lutea* Hook. (AF137588, -, -); *Cleome spinosa* Jacq. (-, DQ649093, -). BRASSICACEAE. **Tribe Aethionemeae**. *Aethionema arabicum* Andrz. ex DC. (AY254539, DQ180218, -); *Aethionema elongatum* Boiss. (-, DQ180216, -); *Aethionema spinosum* (Boiss.) Prantl (GQ424545, -, -). **Tribe Alysseae**. *Alyssum lenense* Adams (-, FN677633, -); *Alyssum montanum* L. (AY237938, -, -); *Berteroa incana* (L.) DC. (EF514632, -, -); *Galitzkya potaninii* (Maxim.) V.V. Botschantz. (-, FN677635, -); *Hormathophylla purpurea* (Lag. & Rodr.) P. Küpfer (-, FN677738, -). **Tribe Alyssopsideae**. *Alyssopsis mollis* O.E. Schulz (-, FJ188227, -); *Alyssopsis trinervis* Botsch. & Seifulin (GQ497846, -, -); *Calymmatium draboides* O.E. Schulz (GQ497854, -, -). **Tribe Anastaticeae**. *Anastatica hierochuntica* L. (GQ424524, -, -); *Malcolmia triloba* Spreng. (DQ357561, -, -). **Tribe Anchonieae**. *Matthiola incana* (L.) W.T.Aiton (AJ628339, -, -); *Microstigma deflexum* (Bunge) Juz. (-, FN677641, -); *Sterigmostemum billardieri* (DC.) D.A. German & Al-Shehbaz (DQ357512, -, -); *Sterigmostemum violaceum* (Botsch.) H.L. Yang (-, FN677640, -). **Tribe Aphragmeae**. *Aphragmus eschscholtzianus* Andrz. ex DC. (DQ165334, -, -); *Aphragmus hobsonii* (H. Pearson) Al-Shehbaz & Warwick (DQ165357, -, -); *Aphragmus oxycarpus* (Hook.f. & Thomson) Jafri (-, DQ518350, -). **Tribe Arabideae**. *Arabis alpina* L. (AF137559, EF449508, -); *Athysanus pusillus* (Hook.) Greene (-, GU246241, -); *Draba aizoides* L. (AF146512, -, -); *Draba alpina* L. (-, DQ467004, -). **Tribe Asteae**. *Asta schaffneri* (S. Watson) O.E. Schulz subsp. *schaffneri* (HQ541168, -, -); *Asta schaffneri* subsp. *stricta* (Rollins) Al-Shehbaz (HQ541171, -, -,-, -). **Tribe Biscutelleae**. *Biscutella didyma* L. (DQ452058, -, -); *Biscutella laevigata* L. (DQ452056, -, -). **Tribe Boechereae**. *Boechera retrofacta* (Graham) Á. Löve & D. Löve (AF183105, -, -); *Boechera suffrutescens* (S. Watson) Dorn (-, DQ013046, -); *Borodinia laevigata* (Muhl. ex Willd.) P.J. Alexander & Windham (DQ452063, EU154153, -); *Cusickiella douglasii* (A. Gray) Rollins (-, AF307557, -); *Sandbergia whitedii* (Piper) Greene (JX146965, DQ406786, -); *Sandbergia perplexa* (L.F. Hend.) Al-Shehbaz (EU275072, EU154107, -). **Tribe Brassiceae**. *Brassica oleracea* L. (AY722423, -, -); *Brassica rapa* L. (JN564039, GQ268033, -); *Diplotaxis erucoides* (L.) DC. (-, AY751763, -); *Eruca vesicaria* subsp. *sativa* (Mill.) Thell. (-, AY751765, -); *Hirschfeldia incana* (L.) Lagr.-Fossat (AY722470, EU620407, -); *Rapistrum* *rugosum* (L.) All. (-, AY751769, -); *Sinapis alba* L. (-, JQ041854, -). **Tribe Buniadeae**. *Bunias erucago* L. (GQ497885, -, -); *Bunias orientalis* L. (-, FN677645, -). **Tribe Calepineae**. *Calepina irregularis* (Asso) Thell. (DQ249822, AY751760, -); *Goldbachia laevigata* (M. Bieb.) DC. (DQ357545, -, -). **Tribe Camelineae**. *Arabidopsis arenosa* (L.) Lawalrée (-, GQ386472, -); *Camelina microcarpa* Andrz. ex DC. (AF137574, DQ821412, -); *Neslia paniculata* (L.) Desv. (-, DQ310518, -); *Pseudoarabidopsis toxophylla* (M. Bieb.) Al-Shehbaz, O'Kane & R.A. Price (AF137558, -, -). **Tribe Cardamineae**. *Cardamine flexuosa* With. (-, AB247985, -); *Cardamine pratensis* L. (AY245995 and AY246025, -, -); *Nasturtium officinale* W.T. Aiton (AY254531, -, -); *Planodes virginicum* (L.) Greene (GQ424554, -, -); *Rorippa indica* (L.) Hiern (-, EF426788, -). **Tribe Chorisporeae**. *Chorispora sabulosa* Cambess. (-, FN677724, -); *Chorispora tenella* (Pall.) DC. (DQ357526, -, -); *Diptychocarpus strictus* (Fisch. ex M. Bieb.) Trautv. (DQ357534, FN677717, -); *Litwinowia tenuissima* (Pall.) Woronow ex Pavlov (-, FN677714, -); *Parrya gracillima* (Popov ex Botsch. & Vved.) D.A. German & Al-Shehbaz (-, FN677652, -); *Parrya podlechii* (Dvořák) D.A. German & Al-Shehbaz (-, FN677719, -). **Tribe Cochlearieae**. *Cochlearia megalosperma* (Maire) Vogt (AF336208, -, -); *Ionopsidium acaule* (Desf.) DC. ex Rchb. (AF336210 and AF336211, HQ268714, -). **Tribe Coluteocarpeae**. *Eunomia oppositifolia* DC. (-, AY122456, -); *Noccaea bulbosa* (Boiss.) Al-Shehbaz (-, AY154798, -,-); *Noccaea cochleariformis* (DC.) Á. Löve & D. Löve (DQ249838, -, -); *Noccaea fendleri* (A. Gray) Holub (AY154824, AY154786, -); *Noccaea jankae* (A. Kern.) F.K. Mey. (-, AY154796, -). **Tribe Conringieae**. *Conringia clavata* Boiss. (AY722505, -, -); *Zuvanda crenulata* (DC.) Askerova (DQ357606, -, -). **Tribe Cremolobeae**. *Aimara rollinsii* (Al-Shehbaz & Martic.) Salariato & Al-Shehbaz (KF662736, KF662775, -); *Cremolobus peruvianus* (Lam.) DC. (KF662763, KF662808, -); *Cremolobus rhomboideus* Hook. (KF662762, KF662807, -); *Menonvillea chilensis* (Turcz.) B.D. Jacks. (KF662739, KF662777, KU764631); *Menonvillea cicatricosa* (Phil.) Rollins (KF662759, KF662801, -); *Menonvillea cuneata* (Gillies & Hook.) Rollins (KF662746, KF662784, -); *Menonvillea minima* Rollins (KF662735, KF662773, -); *Menonvillea scapigera* (Phil.) Rollins subsp. *scapigera* (JX470564, KF662804, -). **Tribe Descurainieae**. *Descurania californica* (A. Gray) O.E. Schulz (-, GU246239, -); *Descurania sophia* (L.) Webb ex Prantl (DQ418727, -, -); *Hornungia alpina* (Sievers) O. Appel (-, DQ310515, -); *Hornungia petraea* Rchb. (AJ628293 and AJ628294, -, -). **Tribe Dontostemoneae**. *Clausia aprica* (Stephan) Korn.-Trotzky (DQ357529, -, -); *Dontostemon integrifolius* (L.) C.A. Mey. (DQ357536, -, -); *Dontostemon intermedius* Vorosch. (-, FN677644, -). **Tribe Erysimeae**. *Erysimum canescens* Roth (-, EU170623, -); *Erysimum capitatum* (Douglas ex Hook.) Greene (DQ357540, -, -); *Erysimum cheiranthoides* L. (DQ005989, EU170622, -). **Tribe Euclidieae**. *Braya alpina* Sternb. & Hoppe (AY353095, -, -); *Euclidium syriacum* (L.) W.T. Aiton (-, EF426780, -); *Neotorularia torulosa* (Desf.) Hedge & J. Léonard (AY353164, -, -); *Solms-laubachia baiogoinensis* (K.C. Kuan & C.H. An) J.P. Yue, Al-Shehbaz & H. Sun (-, DQ523315, -); *Strigosella africana* (L.) Botsch. (-, EU170625, -). **Tribe Eudemeae.** *Alshehbazia hauthalii* (Gilg & Muschl.) Salariato & Zuloaga (KM376235, KM376275, KM376349); *Aschersoniodoxa cachensis* (Speg.) Al-Shehbaz **(**KM376250**,** KM376288, KM376360); *Aschersoniodoxa mandoniana* (Wedd.) Gilg & Muschl. (KM376252, KM376290, KM376362); *Aschersoniodoxa peruviana* Al-Shehbaz, Navarro & A. Cano (KM376253, KM376291, KM376363); *Brayopsis alpaminae* Gilg & Muschl. (KM376242, -, -); *Brayopsis calycina* (Desv.) Gilg & Muschl. (KM376247, KM376285, KM376357); *Brayopsis colombiana* Al-Shehbaz (KM376244, -, -); *Brayopsis diapensioides* (Wedd.) Gilg & Muschl. (KM376243, KM376282, KM376356); *Brayopsis gamosepala* Al-Shehbaz (KM376245, KM376283, -); *Brayopsis monimocalyx* O.E. Schulz (KM376240, KM376280, KM376354); *Dactylocardamum imbricatifolium* Al-Shehbaz (KM376257, KM376295, KM376367); *Eudema nubigena* Bonpl. subsp. *nubigena* (KM376255, KM376292, KM376364); *Eudema nubigena* subsp. *remyana* (Wedd.) Al-Shehbaz (KM376256, KM376293, KM376365); *Eudema rupestris* Bonpl. (KM376254, -, -); *Onuris alismatifolia* Gilg ex Skottsb. (KM376232, KM376272, KM376346); *Onuris graminifolia* Phil. (KM376227, KM376267, KM376341); *Onuris hatcheriana* (Gilg ex Macloskie) Gilg & Muschl. (KM376237, KM376277, KM376351); *Onuris papillosa* O.E. Schulz (KM376229, KM376269, KM376343); *Onuris spegazziniana* Gilg & Musch. (KM376230, KM376270, KM376344); *Stenodraba chillanensis* (Phil.) O.E. Schulz (MF806382, MF806415, MF806446); *Stenodraba colchaguensis* (Barnéoud) O.E. Schulz (MF806383, MF806416, MF806447); *Stenodraba imbricatifolia* (Barnéoud) O.E. Schulz (MF806397, MF806429, MF806455); *Stenodraba lechleri* (E. Fourn.) Ravenna (MF806411, MF806442, MF806466); *Stenodraba lagunae* (O.E. Schulz) Salariato & Al-Shehbaz (MF806394, MF806426, MF806452); *Stenodraba parvifolia* (Phil.) O.E. Schulz (MF806387, MF806420, MF806449); *Stenodraba stenophylla* (Leyb.) O.E. Schulz (MF806403, MF806435, MF806461); *Stenodraba suffruticosa* (Barnéoud) O.E. Schulz (MF806400, MF806432, MF806458). *Xerodraba lycopodioides* (Speg.) Skottsb. (KM376219, KM376259, KM376333); *Xerodraba patagonica* (Speg.) Skottsb. (KM376224, KM376264, KM376338); *Xerodraba patagonica* subsp. *pycnophylloides* (Speg.) Salariato & Al-Shehbaz (KM376222, KM376262, KM376336). **Tribe Eutremeae**. *Eutrema altaicum* (C.A. Mey.) Al-Shehbaz & Warwick (DQ165364, DQ649087, -); *Eutrema heterophyllum* (W.W. Sm.) H. Hara (-, DQ649086, -, -); *Eutrema renifolium* (Boiss. & Hohen.) Al-Shehbaz, G.Q. Hao & J.Quan Liu (GQ424528, -, -). **Tribe Halimolobeae**. *Exhalimolobos berlandieri* (E. Fourn.) Al-Shehbaz & C.D. Bailey (AF307635, AF307538, -); *Exhalimolobos hispidulus* (DC.) Al-Shehbaz & C.D. Bailey (AF307637, AF307544, -); *Exhalimolobos palmeri* (Hemsl.) Al-Shehbaz & C.D. Bailey (AF307636, AF307537, -); *Exhalimolobos parryi* (Hemsl.) Al-Shehbaz & C.D. Bailey (a): (AF307640, AF307539, -), (b) (= *Halimolobos minutiflorus* Rollins) (AF307642, AF307540, -); *Exhalimolobos pazensis* (Rusby) Al-Shehbaz & C.D. Bailey (AF307644, AF307547, -); *Exhalimolobos weddellii* (E. Fourn.) Al-Shehbaz & C.D. Bailey (AF307639, AF307548, -); *Halimolobos diffusus* (A. Gray) O.E. Schulz (AF307645, AF30754, -); *Halimolobos elatus* (Rollins) Al-Shehbaz & C.D. Bailey (DQ336388, DQ336387, -); *Halimolobos henricksonii* (Rollins) Al-Shehbaz & C.D. Bailey (AF307631, AF307545, -); *Halimolobos jaegeri* (Munz) Rollins (JX146962, AF055268, -); *Halimolobos lasiolobus* O.E. Schulz (AF307646, AF307541, -); *Halimolobos pubens* (A. Gray) Al-Shehbaz & C.D. Bailey (AF307630, AF307546, -); *Mancoa bracteata* (S. Watson) Rollins (AF307633, AF307556, -); *Mancoa foliosa* (Wedd.) O.E. Schulz (AF307632, AF307552, -); *Pennellia boliviensis* (Muschl.) Al-Shehbaz (MF806408, MF806439, -); *Pennellia brachycarpa* Beilstein & Al-Shehbaz: (MF806409, MF806440, -); *Pennellia longifolia* (Benth.) Rollins (KX774362, AF307549, -); *Pennellia micrantha* (A. Gray) Nieuwl. (AF307629, AF307551, -); *Pennellia tricornuta* (Rollins) R.A. Price, C.D. Bailey & Al-Shehbaz (AF307628, AF307555, -); *Pennellia yalaensis* Salariato & Al-Shehbaz (xxxxxx, xxxxxx, -); *Sphaerocardamum compressum* (Rollins) Rollins (AF307626, AF307535, -); *Sphaerocardamum divaricatum* (Rollins) Rollins (a) (AF307615, AF307525, -), (b) [= *Sphaerocardamum macropetalum* (Rollins) Rollins] (AF307616, AF307533, -); *Sphaerocardamum nesliiforme* S. Schauer (AF307623, AF307521, -), *Sphaerocardamum stellatum* (S. Watson) Rollins (a) (AF307611, AF307531, -), (b) [= *Sphaerocardamum fruticulosum* (Rollins) Rollins] (AF307624, AF307524, -), (c) [= *Sphaerocardamum macrum* (Standl.) Rollins] (AF307617, AF307523, -), (d) (= *Sphaerocardamum ramosum* Rollins) (AF307619, AF307522, -).**Tribe Heliophileae**. *Heliophila arenaria* Sond. (AJ863600, -, -); *Heliophila coronopifolia* L. (-, DQ518369, -); *Heliophila subulata* Burch. & DC. (AJ863580 and AJ864835, -, -). **Tribe Hesperideae**. *Hesperis isatidea* (Boiss.) D.A. German & Al-Shehbaz (GQ497882, -, -); *Hesperis matronalis* L. (DQ357547, -, -); *Hesperis sibirica* L. (-, FN677642, -). **Tribe Iberideae**. *Iberis amara* L. (AJ440311, AY122455, -); *Iberis spathulata* Bergeret (AJ440312, -, -). **Tribe Isatideae**. *Isatis minima* Bunge (GQ131320, DQ821409, -); *Isatis tinctoria* L. (DQ249851, DQ518370, -) *Isatis zarrei* Al-Shehbaz, Moazzeni & Mumm. (DQ249859, DQ518353, -). **Tribe Kernereae**. *Kernera saxatilis* (L.) Rchb. (AF401118 and AF401119, -, -); *Rhizobotrya alpina* Tausch (AJ440315, -, -). **Tribe Lepidieae**. *Delpinophytum patagonicum* (Speg.) Speg. (KM376225, KM376265, KM376339); *Lepidium angustissimum* Phil. (KC174369, -, KC174447, KC174484, -); *Lepidium apetalum* Willd. (FJ980405, DQ821406, JN045141, -, -); *Lepidium latifolium* L. (AJ582447 and AJ582521, -, -); *Lepidium pavlovii* Al-Shehbaz & Mumm. (DQ780944 and DQ780945, -, -); *Lepidium sisymbrioides* Hook.f. (-, DQ997056, -); *Lithodraba mendocinensis* (Hauman) Boelcke (GQ497890, -, -). **Tribe Megacarpaeeae**. *Megacarpaea delavayi* Franch. (AJ628325 and AJ628326, -, -); *Megacarpaea gracilis* Lipsky (AJ628327 and AJ628328, -, -). **Tribe Microlepidieae**. *Carinavalva glauca* Ising (GQ424527, -, -); *Microlepidium pilosulum* F. Müll. (GQ497869, -, -). **Tribe Notothlaspideae**. *Notothlaspi australe* Hook.f. (AF100689, -, -); *Notothlaspi rosulatum* Hook.f. (AF100690, -, -). **Tribe Oreophytoneae**. *Murbeckiella huetii* (Boiss.) Rothm. (GQ424546, -, -); *Oreophyton falcatum* O.E. Schulz (GQ424549, -, -). **Tribe Physarieae**. *Physaria arctica* (Wormsk. ex Hornem.) O'Kane & Al-Shehbaz (-, GQ245072, -); *Physaria didymocarpa* (Hook.) A. Gray (AF137583, -, -); *Physaria fendleri* (A. Gray) O'Kane & Al-Shehbaz (-, AF055266, -); *Synthlipsis greggii* A. Gray (AF137590, -, -). **Tribe Schizopetaleae**. *Atacama nivea* (Phil.) O. Toro, Mort & Al-Shehbaz (KC174380, KM575848, -); *Mathewsia foliosa* Hook. & Arn. (KC174388, EU620360, -); *Mathewsia peruviana* O.E. Schulz (EU620303, EU620362, -); *Schizopetalon dentatum* (Barnéoud) Gilg & Muschl. (KC174396, -, -); *Schizopetalon rupestre* (Barnéoud) Reiche (KC174402, EU620376, KC174478). **Tribe Scoliaxoneae**. *Scoliaxon mexicanus* (S. Watson) Payson (HQ541174, -, -). **Tribe Sisymbrieae**. *Sisymbrium altissimum* L. (AF531560, AY958545, -); *Sisymbrium septulatum* DC. (AF531600, AY958565, -). **Tribe Smelowskieae**. *Smelowskia alba* (Pall.) Regel (AY230562, -, -); *Smelowskia calycina* (Stephan) C.A. Mey. (-, DQ180249, -); *Smelowskia jacutica* (Botsch. & Karav.) Al-Shehbaz & Warwick (AY230646, -, -); *Smelowskia sisymbrioides* (Regel & Herder) Lipsky ex Paulsen (-, JF298539, -). **Tribe Thelypodieae**. *Dictyophragmus punensis* (Romanczuk) Al-Shehbaz (-, EU620349, -); *Englerocharis pauciflora* Al-Shehbaz (-, EU620351, -); *Hesperidanthus jaegeri* (Rollins) Al-Shehbaz (GQ424569, EU620357, -); *Hesperidanthus linearifolius* (A. Gray) Rydb. (-, EU620358, -); *Ivania cremnophila* (I.M. Johnst.) O.E. Schulz (HQ541176, -, -); *Mostacillastrum andinum* (Phil.) Al-Shehbaz (-, EU620363, -); *Mostacillastrum stenophyllum* (Gilles ex Hook. & Arn.) O.E. Schulz (-, EU620364, -); *Neuontobotrys linearifolia* (Kuntze) Al-Shehbaz (EU620306, -, -); *Parodiodoxa chionophila* (Speg.) O.E. Schulz (JX971121, JX971122, -); *Phravenia viereckii* (O.E. Schulz) Al-Shehbaz & Warwick (HQ541181, -, -); *Polypsecadium arnottianum* (Gillies ex Hook. & Arn.) Al-Shehbaz (-, EU620369, -); *Romanschulzia arabiformis* (DC.) Rollins (AF531635, AY958538, -); *Sibara angelorum* (S. Watson) Greene (b) (-, EU620379, -); *Sibara mendocina* (Boelcke) Al-Shehbaz (-, EU620404, -); *Sibara tehuelches* (Speg.) Al-Shehbaz (b) (-, EU620374, -); *Sibaropsis hammittii* S. Boyd & T.S. Ross (-, EU620380, -); *Stanleya pinnata* (Pursh) Britton (-, EU620381, -); *Streptanthus anceps* (Payson) Hoover (-, JF827264, -); *Streptanthus campestris* S. Watson (-, AY958571, -); *Thelypodiopsis elegans* (M.E. Jones) Rydb. (-, EU620391, -); *Thelypodium flexuosum* B.L. Rob. (-, AY958582, -); *Thelypodium laciniatum* (Hook.) Endl. (EU620328, -, -); *Thysanocarpus curvipes* Hook. (-, GU246194, -); *Warea amplexifolia* (Nutt.) Nutt. (-, EU620397, -); *Weberbaurea herzogii* (O.E. Schulz) Al-Shehbaz (EU620334, EU620400, -); *Weberbauera peruviana* (DC.) Al-Shehbaz (MF806385, MF806418, -, -); *Weberbauera rosulans* (O.E. Schulz) Al-Shehbaz (EU620284, EU620340, -); *Weberbauera spathulifolia* (A. Gray) O.E. Schulz (MF806391, MF806423, -). **Tribe Thlaspideae**. *Peltaria alliacea* Jacq. (DQ249855, -, -); *Thlaspi arvense* L. (AF336152S1 and AF336152S2, DQ821410, HQ596863, KJ480797). **Tribe Yinshanieae**. *Yinshania acutangula* (O.E.Schulz) Y.H. Zhang (AH007969, -, -); *Yinshania acutangula* subsp. *wilsonii* (O.E. Schulz) Al-Shehbaz, G. Yang, L.L. Lu & T.Y. Cheo (AH007968, -).